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# Three nuclei in pollen grains.

BYRON D. HALSTED.

(WITH PLATE XVI.)

The pollen under consideration was obtained by placing twigs of Sambucus racemosa in a tall bell jar of water on March 3d and keeping them in a warm sunny room. The experiment was begun primarily to illustrate to students the effect of coating the cut surface of the severed twig with asphalt or a similar substance impervious to water. There were four similar twigs, each eighteen inches long, placed in the water. Two of them had their cut surfaces coated with varnish, while the remaining two were set in the liquid with the freshly cut ends fully exposed. The asphalt used was that employed for cementing cover glasses to the slides in making permanent microscopic preparations. The buds upon the stems having free cut surfaces quickly began to enlarge, while those of the twigs that had received the varnish did nothing more than slightly swell, and never produced any leaves. The unvarnished stems sent out their characteristic foliage, and at three of the nodes flower clusters of considerable size were developed. It was from these flowers that the pollen was obtained for the observations herein recorded.

The above facts are given because there may be a difference between the behavior of the pollen thus forced before its time and that which would have been produced normally upon the shrubs several weeks later in the season.

When viewed dry, the pollen is about twice as long as broad (20 $\mu$ by 40 $\mu$), and exhibits three dark lines or sutures which run lengthwise of the grain. The appearance of the dry grains is shown at *a* in the plate. All the illustrations were drawn with the camera to the same scale, and are magnified two hundred and eighty times. To the left of *p* are two grains showing the surface of the dry grains. The extine is marked with faint irregular lines, resembling a network of minute cells. This slight obstruction to the view quickly disappears when water is added, and at the same time the grains become nearly spherical and lose all signs of

the original tripartite nature. When treated with a mixture of half water and glycerine the nuclei are easily seen. On the right of *p* are three grains; the upper one shows an end view with the three division lines of the grain. Below this are two grains in which the nuclei are evident. There seems to be a nucleus for each third of the grain. After pollen has been in pure glycerine for two days the grains become plump and the contents are nearly colorless, except the nuclei, which are large and well defined. Three such grains are shown at *c*. In many instances the nuclei seemed united by their ends, while in others all three were evident.

For germination fresh pollen was placed in a ten per cent. solution of cane sugar in one of a nest of porcelain macerating dishes, and forty hours after the tubes were of the lengths indicated in the plate. The earlier stages of germination are shown at *d*. Usually there was a single tube, but occasionally the tube branched as it issued from the grain. In some cases there were two points of departure, as shown near *a* and at *h*. The course of the tube was rarely in a straight line, but instead became much twisted and contorted during the early part of its growth. Afterwards it expanded into a swollen tip as at *e*, where there is a strong tendency to fork at its enlarged extremity. To the left of *e* is a tube which makes a sharp twist near the middle and afterwards swells into an Indian-club-like tip.

The coloring substances which proved the best for the study of the nuclei were eosin and azo-rubin. The latter is by far the best of all substances used for the demonstration of the nuclei. Nearly all of the tubes showing three nuclei, as given in the plate, were treated with azo-rubin. No nuclei are shown in some of the tubes, and these, as at *e* and *t*, were drawn from eosin-prepared specimens. The aceto-methyl green recommended by Dr. Strasburger proved of very little service in comparison with the azo-rubin. This latter substance almost instantly developed a deep blood-red color in the nucleus, while the remaining portion of the protoplasm was left of a lighter hue.

Observations were repeated from day to day with fresh specimens dipped from the culture dish, and the presence of the three nuclei was demonstrated in hundreds of cases. In fact, in nearly all long tubes the three blood-red bodies would appear upon the application of the coloring reagent. In many instances the three nearly equal-sized bodies were found after all else in the tube had disappeared.

The attention of teachers who give laboratory instruction is called to the exceedingly easy way in which an unlimited supply of material was provided for this study. A thoroughly cleaned porcelain dish three inches in diameter and a quarter of an inch deep received an ounce of ten per cent. sugar solution, and into this a large quantity of the pollen was dusted from the flowers. A second dish was placed over the first so as to prevent evaporation and the ingress of mold germs. The nourishing solution was kept in a warm room, for it was yet cold out of doors and snow covered the ground. New pollen was dusted into the syrup from day to day so that all stages of the tubes might be obtained at any time. A preparation for the microscope was made by simply dipping out a drop of the syrup on the cleaned tip of a scalpel and placing it upon a glass slide. Fully a week elapsed before molds began to interfere with the culture. Even after the fungus filaments were producing an entangled mass the pollen and their tubes could be easily determined by the addition of the azo-rubin. This substance did not affect the mold unless very strong, while it almost instantly colored all the protoplasm of the pollen grains and of their tubes.

No mention is found of pollen grains having three nuclei, so far as the literature of the subject has been reviewed by the writer.[1] Dr. Goodale[2] speaks of only two nuclei, one of which is usually larger than the other. Professor Coulter in his paper[3] shows only two. In like manner Professor Barnes[4] demonstrates but two nuclei. If we follow Strasburger, in his later works, the larger is called the vegetative nucleus. With the case in hand the nuclei are all of nearly equal size. As a rule they pass out into the tube early in its development, and generally may be found in the lower half, if not within the club-shaped extremity. When only two nuclei were found in a grain or its tube, one was frequently larger than the other. This fact has led to the suggestion that the larger or vegetative nucleus may undergo a process of division early in the development of the pollen grain. In some of the immature grains only two nuclei were observed, and these seemed to be united by their slender tips, as indicated above *(c)* in the plate.

In closing, the attention of teachers of physiological bot-

[1] Strasburger describes and figures pollen grains with three nuclei in his *Neue Untersuchungen*.—EDS.]

[2] Goodale's Physiological Botany, p. 428.

[3] Pollen spores of Tradescantia Virginica. BOT. GAZ. XI, p. 10.

[4] Process of Fertilization in Campanula Americana. BOT. GAZ. X, p. 349.

any is again called to the very easy manner in which a large supply of germinated pollen was provided for the study here outlined. The same method has proved successful in several other cultures.

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## Fertilization of Calopogon parviflorus Lindl.[1]

CHARLES ROBERTSON.

While at Orlando, Florida, in February, 1887, I found this plant very common in pine barrens.

The flower is interesting from the fact that the ovary is not twisted, so that the labellum occupies the upper side and the column the lower. These parts are at right angles to each other, the labellum being erect and the column curving outward and a little downward. The labellum gradually narrows to a winged basal portion, on which it is hinged. In the wind it often bends forward: in old flowers it falls from its own weight and lies upon the column. In front it is furnished with a conspicuous crest of club-shaped hairs. From above the hairs increase in length so that their tips rise to about the same level. The lower project strongly from the labellum, and many of them are fused together, especially below. When the labellum is bent down upon the column the crest does not reach as far as the stigma. The stigma is at the summit of the column, and is covered with viscid matter. In a little pocket just under the stigma lies the anther, which is two-celled, each cell containing two pollen masses whose grains are lightly connected by threads.

Small bees, Andrenidæ, approaching the flower in front, light upon the crest, when the labellum bends suddenly, so that the dorsal surface of the insect comes down upon the column. The broad, slightly upturned wings of the column keep the body from passing to either side, and so require it to slip off the end. In doing this the body strikes the stigma and is smeared with viscid matter. The pressure of the insect upon the stigma starts the anther from the pocket, so that the ends of the pollen masses are exposed. As the body slips off the end of the column the exposed ends of the pollinia strike the part which is smeared with viscid matter from the stigma, and the pollinia are drawn out and cemented to

[1] Kindly determined by Dr. Sereno Watson. For an interesting account of the morphology of Calopogon and a figure of C. pulchellus, see "Goodale & Sprague," "Wild Flowers," pp. 73 and 85, and pl. xiv.

the exact spot which struck the stigma in the first place. When the insect visits another flower, the part to which the pollen is glued comes down upon the stigma.

Cross-fertilization results from the fact that the stigma is struck before the pollinia, from the startling action of the labellum, and from the fact that only two or three flowers are open at a time. Guignard's[2] opinion, that cross-fertilization is not so well assured as in Pogonia, no doubt, rests on an erroneous view of the floral mechanism.

There is no nectar. If there were any real source of attraction about the crest, small insects which are not heavy enough to depress the labellum would be the only ones to enjoy it undisturbed. The hairs of the crest look like a cluster of dehiscent stamens, for which, I think, they are mistaken by insects. If so, the flower is one of Sprengel's "Scheinsaftblumen," except that the attraction imitated is pollen instead of nectar. Specimens of two species of Halictus, which visited the flowers, had their pollen-carrying hairs well filled, showing that they were on pollen-collecting expeditions. On the other hand, butterflies, which do not visit flowers for pollen, paid no attention to the crest, but sought in vain for nectar near the center of the flower. Guignard[3] saw a bumble-bee light upon the column of C. pulchellus, no doubt expecting to find nectar, while one which I saw pull down the labellum had pollen in her baskets and evidently mistook the hairs for stamens.

In regard to the source of attraction, Guignard[4] says: "There is, indeed, no free nectar, but the basis of the lip and of the column, which are connate, are thickened around a small depression which seems to correspond to the spur of the other genera, and are as if swollen with juices. To insects knowing how to draw from this store the winged column offers a most convenient stage while sucking the sweets. Then the anther is behind them and the pollinia must become attached to their legs, as is the case with the milk-weed." But he did not see the thickened parts punctured by any insect, nor did he find pollinia on the legs of any. The thickened base of the lip seems to be intended to keep it from bending below the hinge, and that of the column to support the weight of an insect which falls upon it. From Guig-

[2] "Insects and Orchids," J. A. Guignard, 16th Annual Report Ent. Soc., Ontario, 1886, p. 43. In the 17th report of the same, p. 51, Guignard gives an interesting account of the fertilization of the Cypripedium spectabile by Megachile melanophaea.

[3] Loc. cit. 39.

[4] Loc. cit. 43.

nard's account, the labellum might as well have no hinge, and the crest would do as well if it were a bright spot on the surface.

The Rev. A. B. Hervey[5] also takes it for granted that the pollinia are fastened to the under side of insects.

When I first noticed the curiously hinged and crested labellum it occurred to me that Mr. Darwin would say that here was the place to look for an explanation of the flower,[6] and I soon formed the theory which I succeeded in verifying. On relating my observations to Professor Trelease, I found that he had held the same view of the flower, and had corresponded with Dr. Hermann Müller on the subject. At my request, Professor Trelease has furnished me with the following note: "Briefly, my idea of Calopogon was that the weight of the insect visitor must bend the labellum so as to bring the bee's back against the column, thus enabling it to effect pollination—a view that Hermann Müller wrote me was the only plausible one he could get from my sketches and notes: but it was never demonstrated in the field."

Calopogon is one of a few flowers which move the insect toward the stigma. In Pterostylis,[7] the labellum flies up elastically and imprisons the visitor in the upper part of the flower, and the insect strikes the stigma in escaping.

There is no expenditure in keeping up a supply of nectar, and the flower, although requiring a smooth insect of a certain size and weight, suffers nothing from the visits of those it can not utilize.

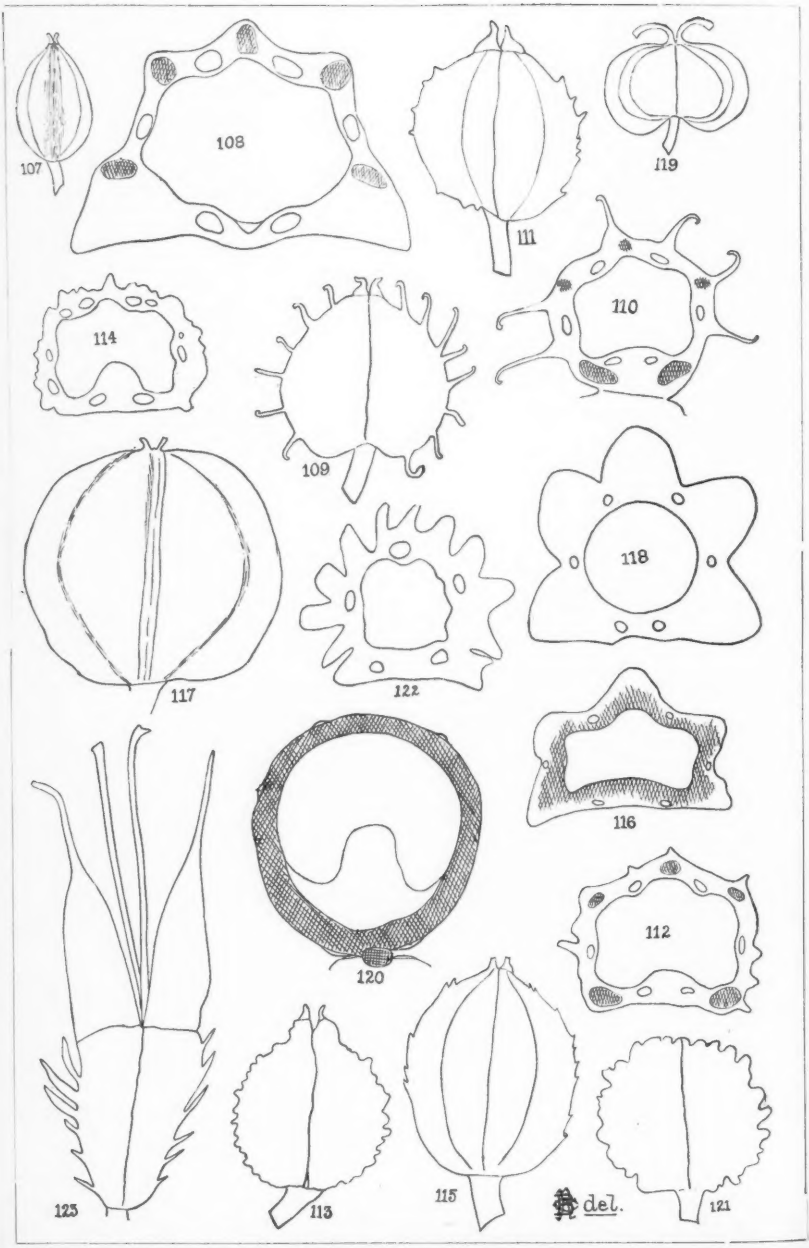
Then, there is no delay caused by the insect waiting to suck, but, as soon as it lights, it is thrown down against the stigma. This occurs so quickly that, while standing with net in hand, I have seen insects effect pollination and escape before I could catch them.

So many orchids fasten their pollinia upon the faces and tongues of insects that it is interesting to find one which applies them regularly to the first abdominal segment. If one wished to place the loose pollinia of Calopogon on some part of the bee where it would be least likely to be disturbed by the bee itself, or by surrounding objects, he could not find a better spot than the place where the flower is adapted to

[5] "Wayside Flowers and Ferns."

[6] Under Mormodes ignea, "Fertilization of Orchids," 216, Mr. Darwin says: "At the close of the twelfth trial I was in despair. The strange position of the labellum, perched on the summit of the column, ought to have shown me that here was the place for experiment. I ought to have rejected the notion that the labellum was thus placed for no good purpose. This plain guide was overlooked, and for a long time I completely failed to understand the structure of the flower."

[7] Darwin, loc. cit. 86.




COULTER and ROSE on UMBELLIFERÆ.

fasten it. Mr. Darwin[8] has observed that absence of hair on the tongues of Lepidoptera and on the faces of Hymenoptera has led to the more usual adaptations, and sparseness of hair has its influence in this case. Species of Augochlora are the only insects on which I found pollinia. These bees are very smooth, depending for ornament on the metallic sheen of their bodies. An Halictus repeatedly pulled down the labella of flowers from which pollinia had not been removed; and the only reason I can assign for its failure to extract pollinia is that it is more hairy than the Augochloras.

I watched the flowers on five mornings between February 21 and March 4, and caught the following insects (Mr. E. T. Cresson kindly determined the Bombus and species of Augochlora):

*Apidæ:* (1) Bombus separatus Cress[9], bending lip but not removing pollinia; *Andrenidæ:* (2) Halictus, do.; (3) Halictus, not bending lip; (4) Halictus, do.; (5) Augochlora festiva Sm., do.; (6) Augochlora sumptuosa Sm., with pollinia on first abdominal segment; (7) Augochlora *n. sp.* do.; *Vespidæ:* (8) Odynerus histrio St. Farg., bending lip, no pollinia; *Syrphidæ:* (9) Mesograpta marginata Say, not bending lip, determined by Dr. S. W. Williston; *Papilionidæ:* (10) Papilio Philenor Linn., not lighting; *Hesperidæ:* (11) Pamphila, the only insect lighting on column.

## Notes on Umbelliferæ of E. United States. VIII.

JOHN M. COULTER AND J. N. ROSE.

(WITH PLATE XVII.)

DISCOPLEURA DC. Fruit ovate, flattened laterally: carpel with 5 primary ribs subtended by strengthening cells; dorsal and intermediates prominent and rather acute; laterals broad and united with a thickened corky margin: oil-ducts solitary in the intervals, two on the commissural side: seed-section roundish (figs. 107, 108).—Smooth branching annuals, with finely dissected leaves (filiform divisions), and white flowers. Fl. June to October.

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1. **D. capillacea** DC. Mem. Umbel. 38. t. 8. Umbels 5 to 20-rayed; involucral leaves (filiform) usually cleft or parted;

[8] Loc. cit. 72.
[9] All of the bees are females.
[*] Section of carpel of Eryngium diffusum X 40.

involucels more or less prominent.—Wet ground, Massachusetts to Florida, and westward to the plains. Runs through many intermediate forms into the

Var. **Nuttallii,** with umbels 15 to 30-rayed, involucral leaves usually entire, and involucels minute (*D. Nuttallii* DC.).—In the lower Mississippi Valley.

Although var. Nuttallii is set apart as a variety, it must be understood to include only extreme forms. There are many forms which intermediate and combine the characters of the species and variety. The number of rays is very inconstant, while the involucral leaves are frequently cleft and entire in different umbels on the same plant, and the involucels may be as prominent in forms which are var. Nuttallii in every other respect, as in true D. capillacea, or they may be very minute in the species itself. Fruit characters entirely fail to give any distinction. As for the form called *D. capillacea*, var. *costata* DC., we are at a loss to discover even any varietal characters. In a large series of specimens so labeled from different herbaria we fail to find the slightest distinction from D. capillacea; and if there is a var. costata we have never seen it, nor is it known to our best collectors.

The two following genera have been referred to *Apium* L.: *Leptocaulis* by Bentham and Hooker, and *Ammoselinum* by Gray. The general habit of the plants and the size of the fruit may indicate some such common relationship, but a study of their fruit structure reveals differences fully as great as obtain among other genera of Umbelliferæ as at present considered. In fact, a glance at the figures representing these two genera and Apium on plate xvii will show a diversity of fruit characters greater than exists among any other three allied genera we have figured. Including these three genera under one would be entirely inconsistent with the definition of other genera of Umbelliferæ. We therefore restore the genera as follows:

LEPTOCAULIS Nutt.—Fruit ovate, flattened laterally, bristly or tuberculate: carpel with 5 primary ribs somewhat prominent or obsolete, each subtended by a prominent group of strengthening cells (except in L. patens): oil-ducts solitary in the intervals (except occasionally in L. patens), two on the commissural side: seed-section dorsally flattened, with face more or less concave: stylopodium conical (figs. 109–114).—Very slender smooth branching annuals, with

finely dissected leaves (filiform or linear segments), and white flowers.

1. **L. echinatus** Nutt. DC. Prodr. 4. 107. A span to a foot high: fruit about half line long, echinate with spreading hooked bristles; ribs obsolete and seed-face slightly concave (figs. 109, 110). *Apium echinatum* Benth. & Hook.—Alabama to Arkansas and westward.

2. **L. divaricatus** DC. Mem. Umbel. 39. t. 10. One to two feet high, with spreading branches: umbels more diffuse than in the last, and usually with fewer rays: fruit half a line long, tuberculate; ribs somewhat prominent and seed-face slightly concave (figs. 111, 112). *Apium divaricatum* Benth. & Hook.—North Carolina to Florida and westward to Texas.

3. **L. patens** Nutt. DC. Prodr. 4. 107. One to two feet high, branching above: fruit half a line long, tuberculate; ribs obsolete and seed-face decidedly concave; pericarp thinner than in the preceding species and without strengthening cells; oil-ducts in the intervals often accompanied by smaller accessory ones (figs. 113, 114). *Apium patens* Watson, Bibl. Index, Polypet. 413.—From Missouri to Louisiana and Texas. This species, while undoubtedly most closely related to Leptocaulis, is exceptional in certain important characters. The thinner pericarp, the entire absence of strengthening cells, the frequent increase in the number of oil-ducts, and the almost sulcate seed-face are all characters that do not belong to Leptocaulis. While, therefore, we include it under this genus, it must be considered as an outlying member.

AMMOSELINUM Torr. & Gray.—Fruit ovate, flattened laterally: carpel with 5 prominent equal more or less scabrous ribs, the laterals closely contiguous to those of the other carpel, forming apparently a single rib: pericarp exceedingly hard, composed almost entirely of strengthening cells: oil-ducts solitary in the intervals, two on the commissural side, rather small and not close to seed cavity: seed-section dorsally flattened, with face slightly concave: stylopodium conical, with very short style (figs. 115, 116).—Low diffuse annual, with ternately divided leaves, the small ultimate segments linear to spatulate, and white flowers in small sessile or short-pedunculate unequal-rayed umbels.—This is one of the best marked genera of Umbelliferæ. Its affinities are doubtful, but it holds no relation whatever to Chærophyllum, as was surmised in the original description, followed by Bentham and Hooker.

1. **A. Popei** Torr. & Gray, Pacif. R. Rep. 2. 165. About a span high, angles, midribs, rays, pedicels, and ribs of fruit rough scabrous: leaf-segments narrowly linear: fruit ovate-oblong, 2 to 2½ lines long, with thick corky commissure. *Apium Popei* Gray.—Texas *(Wright, Parry, Reverchon)*. Fl. April, May.

2. **A. Butleri.** Smaller, nearly glabrous: leaf-segments narrowly oblong or spatulate: fruit ovate, about a line long, with ribs smooth or minutely scabrous, and corky commissure much less prominent (figs. 115, 116). *Apium Butleri* Eng. Proc. Am. Acad. xxi. 453.—Texas *(Hall, Reverchon, Joor)*; Indian Territory *(Butler)*. Fl. March, April. Distributed in various collections as Apium Popei.

APIUM Linn.—Fruit ovate or broader than long, flattened laterally: carpel with 5 prominent obtuse corky nearly equal ribs: pericarp with no strengthening cells: oil-ducts solitary in the narrow intervals, two on the commissural side: seed-section round: stylopodium depressed or wanting (figs. 117, 118).—Erect or prostrate herbs, with pinnately or ternately divided leaves, umbels opposite the leaves, and white flowers.

1. **A. leptophyllum** F. Muel., Benth. Fl. Austral. 3. 372. A few inches to two feet high: leaves ternately divided into filiform segments: umbels sessile or short-pedunculate: fruit a line long. *Helosciadium leptophyllum* DC.—Florida to Texas and westward. March to June.

*A. nodiflorum* Benth. & Hook. (*Helosciadium nodiflorum* Koch), an introduced species, reported first by Walter around Charleston, S. C., and not afterwards found, has been recently collected by Dr. J. H. Mellichamp. It is also found on the ballast grounds near Philadelphia by I. C. Martindale.

BIFORA Hoffm.—Fruit broader than long, flattened laterally, the two globose carpels connected only by a narrow commissure: carpel with primary ribs obsolete, and 4 filiform secondary ribs: pericarp thin and very hard, made up almost entirely of strengthening cells: oil-ducts none: seed-face deeply concave: stylopodium conical: styles recurved over the carpels (figs. 119, 120).—Slender smooth annuals, with pinnately dissected leaves (segments filiform), and white flowers in few-rayed umbels.

1. **B. Americana** Benth. & Hook. Gen. Pl. 1. 926. A foot or more high, branching above, rays and angles of stem (es-

pecially summit of internodes) roughened with minute callous points: fruit 1½ lines long, 2½ lines broad. *Atrema Americana* DC.—Missouri *(Tracy)*, Arkansas and Texas.

ERYNGIUM Linn.—Fruit ovate or obovate, flattened laterally, scaly, tuberculate or bristly: carpel with ribs obsolete (in ours): pericarp without strengthening cells: oil-ducts solitary beneath the ribs (or their normal position), two on the commissural side (making 5 in all): seed-face plane: styles filiform (figs. 121–124).—Herbs with spiny or prickly mostly lobed or toothed leaves, and bracted flowers closely sessile in dense heads.—A large genus, with about 20 North American species, chiefly southern. The genus is so well defined by its general habit, and mature fruit is so completely lacking in our herbaria, that in the present series of papers we will not undertake to define the species. We would urge upon collectors the necessity of securing good fruiting specimens of all our Eryngiums, as in the few species studied there is indicated a wide range of fruit structure.

With this paper is concluded the presentation of our 80 species of Umbelliferæ east of the 100th meridian. It is to be hoped that the characters presented will be subjected to a thorough test by collectors and herbarium workers, that in the final elaboration of the North American representatives of the family the most permanent possible results may be obtained. At the same time we would ask for additional material from all quarters, especially fruiting specimens. We are under great obligations to many botanists, to whom we have already, in earlier papers, given our grateful acknowledgments.

EXPLANATION OF PLATE XVII.—Fig. 107, fruit of Discopleura capillacea; fig. 108, section of carpel of same; fig. 109, fruit of Leptocaulis echinatus; fig. 110, section of carpel of same; fig. 111, fruit of L. divaricatus; fig. 112, section of carpel of same; fig. 113, fruit of L. patens; fig. 114 section of carpel of same; fig. 115, fruit of Ammoselinum Butleri; fig. 116, section of carpel of same; fig. 117, fruit of Apium leptophyllum; fig. 118, section of carpel of same; fig. 119, fruit of Bifora Americana; fig. 120, section of carpel of same; fig. 121, fruit of Eryngium aromaticum; fig. 122, section of carpel of same; fig. 123, fruit of E. diffusum. Fig. 119 is ×5; fig. 107 is ×7; figs. 109, 111, 113, 115, 117, 120, 121, 123, are ×22; figs. 108, 110, 112, 114, 116, 118, 122, are ×40.

## BRIEFER ARTICLES.

**Solanum triflorum** Nutt.—Five years ago this plant was comparatively uncommon in Northern Montana. It might then be found here and there on the prairies or near water-courses, but now, during the past three years, it has been noticeably increasing, owing to the rapid influx of people who, instead of going into stock-raising or mining, have turned their attention to agricultural occupations. The plant grows better in cultivated ground, and it is a fact worth recording that it grows best of all in situations particularly suited to the development of S. tuberosum. In its finest condition the plant spreads over the ground in mats three feet or more across the branches, usually rooting all along the portions touching the earth, and bearing many pale blue to purplish flowers, similar in general appearance to those of S. tuberosum, but much smaller. Where the plant is found on the wild prairies it is often low but nearly erect, sending out short lateral ascending branches, which bear small, pale, often yellowish, less conspicuous flowers, and the subsequent berries are usually a little smaller and less numerous than in the field form.

One day during August, passing through a field of potatoes, the owner of which, who was with me, and evidently an intelligent man, pointing to a heavy musky-smelling mat of S. triflorum, asked the name of those "wild potatoes." I replied by asking why he called them wild potatoes. "Well," said he, "they are, aren't they? They bear flowers like a potato, and potato-bugs live upon the leaves." I had noted the latter fact several years before, but had never seen the larvæ very numerous upon the plants. This season, however, an enormous crop of potato-beetle larvæ has been produced, and chiefly upon S. triflorum. This species seemed, even where S. tuberosum was also present, to be mainly used as the preliminary or original host, from which many, but by no means all, of the larvæ, after attaining a certain size, would crawl to plants of the other species.—F. W. ANDERSON, *Great Falls, Montana.*

**Coptis, section Chrysocoptis.**—Any one collecting in Idaho (say on the Pend d'Oreille river, or on the Lolo trail above Clear Water) in the spring should look out for Coptis occidentalis, the flowers of which are a desideratum. In Wyeth's four specimens they are undeveloped, and little can be made of Nuttall's figure in this respect. Geyer's specimens were going out of flower; but I have found withered remains of a sepal and a petal. When good flowers are obtained the three following species will propably be confirmed:

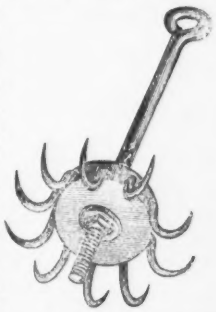
C. OCCIDENTALIS Torr. and Gray. Leaves simply trifoliolate: leaflets long-petiolulate (2 or 3 inches long at maturity, with terminal petiolule 1–1½ inches long, and lateral ones hardly half shorter), of roundish outline, 3-lobed to middle; the lobes obtuse, slightly 3-cleft or incised, and obtusely dentate: petals shorter than sepals, subulate from a subsessile

hardly nectariferous base: mature carpels longer than stipe: seeds oblong.

C. LACINIATA Leaves trifoliolate: lateral leaflets comparatively short petiolulate; all ovate in outline, nearly 3-parted, with divisions 3-7-cleft or incised and dentate, mostly acute: sepals linear-attenuate, and filiform-attenuate petals nearly of the next species: mature carpels longer than stipe: seeds oval.—*C. asplenifolia* Gray, Proc. Am. Acad., viii. 375, and Watson, Bot. Calif, ii. 427. This we have only from Oregon and Northwest California, collected by E. Hall, Cusick, Henderson, G. R. Vasey, Rattan. Only Cusick has sent it in blossom.

C. ASPLENIFOLIA Salisb. Leaves pinnately 5-foliolate; with leaflets all slender-petiolulate, ovate-oblong in outline, and pinnately divided or parted, lower divisions short petiolulate and upper confluent: sepals and petals filiform-attenuate, nearly equal; the latter with thickened concave nectary between middle and base: mature carpels shorter than the stipe. We have this only from British Columbia and Alaska.—ASA GRAY.

**Dredge for Chara.**—Last year, in giving directions for the collection of Characeæ, I recommended a modification of a dredge used by Prof. Nordstedt, of Sweden. I am constrained to say that a dredge more like his original one is better for deep water, and that the one here illustrated answers perfectly every purpose, provided one carries, as I now do, a small rake for shallower water. This dredge consists of a disk of lead about three inches in diameter and three-fourths of an inch thick, in the edge of which are imbedded about ten hooks. I have had them bent backward in order to furnish a kind of "shoulder" to give greater strength in case of catching in an obstruction. These will firmly hold a boat, or raise a couple of hundred pounds from the bottom. Through the center of this disk is passed, vertically, an iron rod about a foot long, which has a ring in the upper end, for a line, and which is allowed to project about three inches below the disk. It takes apart readily by means of a nut and screw on the rod, and packs in a small box. It weighs about two and a half pounds, and is made by Flynn & Doyle, Bantam, Conn., at a cost of four dollars.—T. F. ALLEN.



## OPEN LETTERS.

### Vitality of seeds.

In making the excavation for the new building of Franklin College last fall, the dirt was hauled upon the campus, and in a short time it was noticed where the soil was placed a great many specimens of poke-weed (Phytolacca decandra) were growing. The north building was erected in

1844, and the south building in 1854, and these two buildings stand forty-seven feet apart. It was in this space the excavation was made. These seeds have been lying dormant in all probability since 1844, as students do not generally permit such plants to grow within forty-seven feet of the college.

D. A. OWEN.

*Franklin, Ind.*

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**Dispersion of seeds in Euphorbia.**

It may be worth noting, in connection with the interesting remarks of Dr. Schneck on the dispersion of seeds of Euphorbia marginata (page 226), that the phenomenon is recorded in connection with other Euphorbiaceæ, especially in a small Mexican tree, there known, according to Hernandez, as 'Quauhtcatlatzin," which I suppose might be translated as the "creaking tree." In view of this Mexican term, Linnæus seems to have given it the name of Hura crepitans. De Candolle (Prodromus 18, p. 1229) remarks on it: "Cocca * * *valde crepitanter dissilientia seminaque dejicientia.*"

THOMAS MEEHAN.

*Germantown, Penn.*

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**Systematic Botany—A correction.**

In the note on "the old and new botany," in the October GAZETTE, an error occurs, namely, the omission of the word *systematic* before botany in the seventh line from the last. As it stands, it reads that the general subject, *botany*, is falling into disfavor, which I am sure is not true. But it is quite clear to me that systematic botany is considered as quite detached from the living processes going on in plants, and, therefore, falling into disfavor.

E. L. GREGORY.

*Bryn Mawr College.*

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## CURRENT LITERATURE.

*Hepaticæ Americanæ;* prepared by Lucien M. Underwood and O. F. Cook. Decades I and II. Syracuse, N. Y. 1887.

Under the above title Dr. Underwood, of Syracuse University, and Mr. Cook have begun issuing a set of *exsiccatæ* for the special encouragement of students undertaking the collection of Hepaticæ. As no preface to the set has been issued, we are authorized to say that the object of the publishers has been:

1. To issue this preliminary set more for the assistance of beginners than as a matter of *special* interest to those who have long studied the Hepaticæ. Later numbers may have a wider interest.

2. By issuing a *few* numbers to bring the price[1] within the reach of the most moderate means.

3. To issue representative (though common) species.[2] The four

[1] The set of twenty numbers will be sent postpaid for $1.25. Address Dr. Lucien M Underwood, Syracuse, N. Y.

[2] The twenty numbers are as follows: Riccia natans, Marchantia polymorpha, Conocephalus conicus, Anthoceros lævis, Blasia pusilla, Steetsia Lyellii, Frullania Grayana, Lejeunia serpyllifolia, var. Americana, Madotheca porella, Radula complanata, Ptilidium ciliare, Bazzania trilobata, Trichocolea tomentella, Lepidozia reptans, Kantia trichomanis, Geocalyx graveolens, Cephalozia curvifolia, Jungermania Schraderi, Scapania nemorosa Plagiochila porelloides.

orders, all the larger genera, and the thallose, incubous and succubous Jungermaniaceæ will be found represented.

4 To procure specimens as free as possible (a by no means easy task) from other and misleading plants

From an examination of the set we are prepared to say that the specimens are admirable, and leave nothing to be desired. The labels are full and are accurately printed. We sincerely hope that the au hors will be liberally encouraged not only by the purchase of sets, but also by the contribution of material; and that the sets may soon begin to include the rarer species. Certainly, the enterprise is most commendable, and must prove of great benefit to all students of Hepaticæ.

*Synopsis of the Flora of the Laramie Group.* By Lester F Ward Sixth Annual Report of Director of the U. S. Geological Survey, 1884–85. Washington, 1886; pp. 405–557, pl. 31–65.

Perhaps no controversy over the stratigraphic position of any of the various members in the geologic series has been waged with greater persistency than has that over the position of the member now so well known as the Laramie Group. This group was first brought to light by the pioneer investigators of the geology of our western territories, and they, together with prominent paleontologists, from considerations of its animal remains, were led to refer it to the cretaceous age. Others, equally eminent, basing their conclusions upon examinations of the plant as well as animal remains, argued for it a tertiary age So persistently have these two theories been attacked and defended that the subject has developed a copious literature of its own; and for the general student to attempt to read this and decide for himself is a nearly hopeless task. What was needed was a succinct account of the progress of opinion regarding it, irrespective of partisan feeling. This is precisely what Prof. Ward has done in the historical review of opinion which occupies the first forty pages of his memoirs, and the result must be conclusive. From this it is seen that the conclusion generally accepted at present is that the Laramie group belongs as much to the cretaceous as to the tertiary, or rather occupies a somewhat intermediate position between the two. But, as Prof Ward so pointedly suggests, it makes very little difference whether we regard it as belonging to the one or to the other, so long as we clearly understand its relative position. We know positively that the next member below it is upper cretaceous and the next above it is lower tertiary.

As it is now understood, this formation, which has a thickness of more than 4000 feet of strata, occupies a vast area, extending for hundreds of miles on either side of the Rocky mountains and from Mexico to far within the British possessions. This immense inland sea was at first filled with brackish water, with at least one opening into the ocean; but afterward, through the gradual cutting off of this avenue of intercommunication, it became nearly or quite fresh. The period of change

from the one to the other must have been very gradual, and have extended over an immense interval of time; long enough, indeed, as Dr. C. A White has so clearly shown, for the transformation of a distinctively brackish water molluscan fauna to a fresh water fauna, without extinction of types It is in these peculiarities that lies the explanation of the difficulty experienced in attempting to correlate this formation with others probably deposited at the same time in different parts of the world. It would be extremely improbable that precisely similar conditions should prevail in widely separated localities cut off, as we know they must have been, by barriers of both land and water that existed at that time.

In order to ascertain what answer an exhaustive examination of the plant remains would be able to give to the question, Prof. Ward has prepared an elaborate table, in which are compared all the known species found in the Senonian, Laramie and Eocene formations. The result shows that the Laramie flora resembles the one about as much as the other, which in itself proves nothing; but in the discussion which follows the table it is concluded, in a manner satisfactory to the author, at least that it has a stronger Senonian than Eocene facies. This is because more important types extend from the Senonian into the Laramie, and when, as it is well known, the vegetation was less diversified than later The flora of the Laramie period is perhaps no more remarkable than could be accounted for on the ground of the peculiar conditions which obtained at the time of its deposition. Its isolated character, its change from a brackish to a fresh water deposit, are sufficient to impress upon it a strong individuality. This examination shows more plainly than ever that the whole discussion resolves itself into a mere question of a name, and what this shall be is not of as much importance as might at first be anticipated.

This discussion is followed by the systematic portion of the paper which deals with the results of the personal observations of the author upon the flora of this group. This is in the form of a list, unaccompanied by descriptions, of the type or representative species detected in the collections made by Prof. Ward in Colorado, Wyoming and Montana. The descriptions and discussions of species are to be found in a later work, to which this list is but supplementary; and, indeed, both papers are designed as an introduction to the larger monograph which the author has in preparation.

The illustrations, which are by the photo-lithographic process, are among the best of the kind that we have seen.

Taken as a whole, this paper must be regarded as one of the most valuable contributions that have been made to the discussion of the Laramie group.*

*Types of the Laramie Flora.* By Lester F. Ward. Bulletin of the U S. Geological Survey, No. 37. Washington, 1887. Pp. 1–115, pl. 1–57.

In this paper the species given in a list in the former work are de-

scribed and discussed at length. The illustrations are also the same, having been rearranged to accommodate them to the reduced size of the work.*

*Grasses and Forage Plants.* By Charles L. Flint. Revised edition, 12°, pp. 398. Lee & Shepard: Boston, 1888.

This, although called a "revised" edition, is practically the same as that published twenty-four years ago, the only changes of any importance being confined to about half a dozen pages, where new illustrations of some more recent agricultural machines are substituted for old ones, with some cutting out and change of type to correspond. The only new matter relating to forage plants is on page 196, where a short account of Japan clover (Lespedeza striata) is introduced, and even this is not included in the systematic index. The preface is unchanged from the sixth edition of 1864, except in giving a new date—1888 instead of 1859—not even mentioning the few changes already noticed. It is, therefore, little more than a reprint of the old edition of twenty years ago. As that has been a long time before the public, its many excellent qualities are well known.

But, in a "revised edition," after the lapse of so many years some important changes or additions might reasonably have been expected. Within the last ten to twenty years the subject of grasses for cultivation has in certain portions of our country attracted very great interest. Extensive tracts of country west of the Missouri river, and southwestward in Texas and New Mexico, have been brought under culture, subject to climatic conditions very different from those of the Northern and Eastern States, and the belief is very generally entertained that the older kinds of cultivated grasses are not adapted to use there; and intelligent agriculturalists are inquiring and experimenting with reference to some grasses better adapted to their wants. Very much the same condition exists in the South Atlantic and Gulf States, where long summer droughts prevail, greatly to the injury of the grazing interests, and a number of new and promising grasses and forage plants are under trial. These points are entirely ignored in this "revised edition."

In another particular the public might naturally look for some change. This is in relation to the botanical terms and the classification employed in the description of grasses in the introductory chapter. A proper revision would have changed the botanical names of ten or twelve genera, and would have changed the application of some of the terms used in describing the parts of the flower. Thus, Calamagrostis (of our country) is now Deyeuxia, Brizopyrum is Distichlis, Lepturus (of our country) is known as Schedonnardus, our Triticums are Agropyrums, Dupontia is called Graphephorum, Gymnostichum is Asprella, etc. The application of the terms glume and palet should have been modified so as to express the modern view of the structure of grass flowers—the term glume being now extended to include what was formerly called the lower palet, and

the term palet being restricted to that bract or scale formerly known as the upper palet. Several other needful changes of terms will occur to the botanist, as well as in the loose employment of the terms ovary and seed on page 15.—GEORGE VASEY.

*Monographiæ Phanerogamarum.* Vol. quintum, pars secunda. Ampelideæ. Auctore J. E. Planchon. Pp. 305-654. Paris, July, 1887.

Few groups of plants are more perplexing than the one forming the subject of this monograph, and as a consequence there are wide differences in its treatment. The present presentation makes some radical changes. Bentham and Hooker in their Genera Plantarum group three genera under Ampelideæ, viz.: Vitis (including Ampelopsis and the large tropical genus Cissus), with 230 species; Pterisanthes, with three; and Leea, with about twenty. Planchon, in the monograph before us, does not include Leea as being among the true Ampelideæ; accepts Pterisanthes as defined, but increases its species to eleven; and of Bentham and Hooker's Vitis makes nine genera. VITIS is left with twenty-eight species, and in it are all our American vines (sixteen in number) except the few noted further on. *V. aranea* Leconte, from N. Georgia and Athens, Ill., is new to our manuals, and the *V. monticola* of Eng. is *V. Berlandieri* Planchon. AMPELOCISSUS is a new tropical genus of sixty-two species, heretofore included under Vitis, none of which concern us, except two in Mexico and one in the West Indies. CLEMATICISSUS is the Australian Vitis angustissima, and is monotypic. TETRASTIGMA, once a section of Vitis, and also of Cissus, is an Asiatic genus of thirty-eight species. LANDUKIA is a monotypic genus, founded upon a species which has been variously referred to Ampelopsis, Cissus and Vitis, and now rejoices in the name Landukia Landuk. PARTHENOCISSUS is *Ampelopsis* Mx., in part, and to it belongs our Virginia creeper, which is, therefore, *Parthenocissus quinquefolia* Planch., and six other species. AMPELOPSIS Mx., the other part, we get back again, not to include our old Ampelopsis, however, but some species that we have been referring to Vitis. *Vitis indivisa* Willd. is now *Ampelopsis cordata* Mx., and *Vitis bipinnata* T. & G., which was *V. arborea* L., is *Ampelopsis bipinnata* Mx. RHOICISSUS is separated from Cissus, with nine species, while CISSUS remains the largest genus, with 214 species.

*The Development of the Ostrich Fern.* By Douglas Houghton Campbell, Ph. D. Memoirs of the Bost. Soc. Nat. Hist., Vol. IV, No. 2. Pp. 17-52, with four plates. Boston, April, 1887.

This is the Walker prize essay of 1886, that was so worthily won by Dr. Campbell. Since that time the author has been studying in Germany with Strasburger, Pfeffer, and now with Kny, and we predict for him a very successful botanical career. The paper before us gives evidence of fine ability, and is a model in its way. It is so compact and technical that it hardly admits of a review further than a notice of its contents.

The important points discussed the author himself sums up as follows: The presence of a third coat in the spore; the marked dioecism

displayed by the prothallia; formation and development of the apical cell of the prothallium; continuity of the protoplasm in the cells of the prothallium; development of the antheridium and antherozoids; absence of the ventral canal-cell in the archegonium; succession of the divisions of the embryo, and the establishment of the apical cells of its different members; development of the different tissues of the embryo; development of the leaf from the apical cell and the relation of the different tissues of the leaf to the segments of the apical cell; method of formation of the pinnæ; development of the stem from the apical cell; development of the sporangium. These subjects indicate the completeness of the study. A very interesting fact brought out is the vitality of the spores, and the ease with which they can be germinated. The plant can thus be had at any time for study.

*Illustrationes floræ insularum maris Pacifici.* E. Drake Del Castillo. Fascicles I–III. Quarto. G. Masson, Paris, 1886–1887.

The author proposes to issue from time to time fascicles of ten species; each species with descriptive text and a full page lithographic plate. Not all the Pacific island species are to be included, but those that are new, rare, or especially interesting. In the resumé of the publications concerning the flora of this region one is surprised at its copiousness. The three fascicles before us bring us thirty species, many of them new, and thirty plates. It is one of those works that demonstrate the highest possible skill of the printer and engraver, and to which one sits down as to a book of fine engravings. The typography, although of marvelous clearness, can be equaled in this country, but it is to these matchless European engravings that we must yield. Our artistic engravings, such as appear in *Century* or *Harper*, are fine enough, but our scientific engraving and plate-printing, compared with that in the work lying before us, is dreadfully coarse. The explanation probably lies in the fact that all such work here must be done as cheaply as possible, and of course in an inferior way.

*Parasitic Fungi of Illinois.* Part II. Erysipheæ. (Bulletin of the Illinois State Laboratory of Natural History, Vol. II. No. 6.) By T. J. Burrill and F. S. Earle. Peoria, 1887. 8°, pp. 46. Illustrated.

The surface mildews have been elaborated in the present paper with the same thoroughness and discriminating judgment that the rusts received in the first contribution to the parasitic fungi of the state. The introduction deals with their structure, development and classification, together with an account of the parasite, Cincinobolus. The genera are illustrated after the manner of Winter in the "Flora von Deutschland," and are provided with a key.

Twenty-eight species are admitted, with full diagnoses drawn from the specimens in hand, the synonymy traced, each host with its locality and herbarium number given, and critical remarks appended. The list embraces all the species enumerated by Trelease for Wisconsin (Para-

sitic Fungi of Wisconsin), by Bessey for Iowa (Bull. Iowa Ag. Coll.), by Rose for Indiana, except one (Bot. Gaz., ix), and forty-two of the sixty-one species given by Bessey for the whole United States (the Erysiphei), with two in addition.

The feature which gives a value beyond that of a local list is the careful study of the limits of the species, and the consequent synonymy. The forty-two species of Bessey's United States list, with two not in it, making forty-four, are reduced to twenty-eight, showing an actual condensation of more than one-third, although two of the species were doubled instead of contracted. The principal changes are as follows:

| PRESENT NAMES. | FORMER NAMES. |
|---|---|
| Sphærotheca Humuli (DC.) Burrill. | S. Castagnei in part. |
| Erysiphe Galeopsidis DC. . . . | E. lamprocarpa in part. |
| Erysiphe Cichoracearum DC. . . | E. lamprocarpa in part.<br>E. Montagnei.<br>E. horridula. |
| Uncinula Salicis (DC.) Winter . . | U. adunca.<br>U. heliciformis.<br>U. leuculenta. |
| Podosphæra Oxyacanthæ (DC.) DeBary | P. Kunzei.<br>P. trydactyla.<br>P. minor.<br>P. Myrtillina. |
| Microsphæra Quercina (Schw.) Burrill | M. extensa.<br>M. abbreviata. |
| Microsphæra Alni (DC.) Winter. . | M. Hedwigii.<br>M. penicillata.<br>M. pulchra.<br>M. Friesii.<br>M. Platani.<br>M. Van Bruntiana.<br>M. Viburni. |

Furthermore, Erysiphe communis is made to include E. Martii, and Uncinula Ampelopsidis to include U. Americana, U. spiralis and U. subfusca. It is now also pointed out that the gooseberry mildew belongs to Sphærotheca Mors-Uvæ, and not to S. pannosa, while the clematis mildew is Erysiphe communis, and not E. tortilis; changes which appear to be necessitated by former errors of determination. The data and conclusions given under Podosphæra Oxyacanthæ are essentially the same as published in this journal three years and a half ago by one of the authors, but the fac is not mentioned.

Few classes of fungi were in greater need of revision than the surface mildews, and the advancement made by Dr. Burrill and Mr. Earle in this paper will doubtless, in the main, meet with the approval of systematists. A change, the value of which might be questioned, is the placing of so many forms under M. Alni, including the exclusively American one on lilac. Culture experiments are much needed to throw more light upon points like this.

## NOTES AND NEWS.

DR. B. D. HALSTED is spending his winter vacation at Passaic, N. J., his old home.

"THE CONCEPTION of species in cryptogamic botany" is the title of a paper by Dr. W. G. Farlow read before the Boston Society of Natural History at its November meeting.

IT HAS BEEN found that herbivorous fish aid largely in disseminating algæ, numerous species being found in the stomachs of such fish. Very often the fertile portions are eaten and the viable spores voided.

DR. J. W. ECKFELDT and W. W. Calkins have begun an enumeration of the lichen flora of Florida in the *Journal of Mycology* for November. The first installment embraces 146 numbers, and reaches Cænogonium.

A SEPARATE author's edition of the report for 1886 of the mycologist to the U. S. Department of Agriculture, Prof. F. L. Scribner, has been distributed. It contains forty-four pages, seven plates, three maps and one diagram.

DR. HERMANN VÖCHTING has been called to the Professorship of Botany in the University of Tübingen, and Dr. Klebs, privat docent at Tübingen, to the professor's chair at the University of Basel, vacated by Dr. Vöchting.

IN THE August GAZETTE (p. 199) we made the unintentional blunder of announcing that Dr. DeBary had been appointed professor at Leipzig to succeed Prof. A. Schenk. Instead of Dr. DeBary, it should have read Prof. Pfeffer.

REV. F. D. KELSEY, of Helena, Montana, recently delivered a lecture before the teachers' institute of Lewis and Clarke counties, entitled, "A bird's-eye view of botany," in which he gave an outline of the history of botany and an explanation of modern classification.

THE Western Pennsylvania Botanical Society, of Pittsburgh, has elected the following officers for the coming year: John D. Shafer, president; Dr. A. Koenig, vice-president; Miss Willa Matthews, recording secretary; Prof. B. H. Patterson, corresponding secretary; C. C. Mellor, treasurer.

SOME marked differences between the typical Acer saccharinum and the variety nigrum are pointed out and illustrated by Prof. L. H. Bailey, Jr., in *Popular Gardening* for November. The chief differences lie in the shape and size of the fruit, and in the contour and habit of the leaves.

THE ELECTRIC lighting of the Winter Palace at St. Petersburg has brought great damage to the ornamental plants used for decoration. The complete illumination of the room for a single night is enough to cause the leaves to turn yellow, dry up, and ultimately to fall off. The celebrated collection of palms has especially suffered.

A NEW weekly journal of horticulture, landscape gardening and forestry, entitled *Sylva*, is to be started early in the new year, under the editorship of Prof. Charles S. Sargent, of Harvard College. It aspires to be an authority on questions coming within its scope, and will prove a welcome addition to scientifico-practical literature.

THE NEW fossil group, *Bennettites*, recently described by Count Solms-Laubach as between angiosperms and gymnosperms, accord with cycads in vegetative structure, but possess undoubted gymnospermous fruits.

THE OCTOBER number of the *Journal of the Royal Microscopical Society* contains a monograph of the genus Lycoperdon by G. Massee, F. R. M. S. Mr. M. recognizes 129 species, of which 49 are found in Europe and 26 in the United States. Doubtless, the revision of the puff-balls of the United States, which we may expect at an early day from the pen of Dr. William Trelease, will modify this estimate materially.

A COURSE of five lectures on the dissemination of plants by Dr. William Trelease, Director of the Shaw School of Botany, has been announced. The course began on November 18th, and is to be continued on Friday evenings. Dr. Trelease has collected numerous illustrations for this series, both from the works of others and his own studies, and the synopsis of the lectures promises a most interesting course.

MR. C. R. ORCUTT, of San Diego, Cal., desires to secure young, active men, with enthusiasm for natural history work, and with scientific training, as well as older and more experienced scientists, to collect for him in all departments in Lower California, Western Mexico and Central America. It is not a financial venture, and little more than expenses need be expected, but due credit will be given collectors for their work.

C. C. BABINGTON, in a review of Professor Areschoug's paper on the genus Rubus, in *Journal of Botany*, remarks that "it is far too thoroughly pervaded by the theory of evolution to be quite satisfactory to those who continue to look upon that as a *theory rather than a fact*." (Italics in the original.) The student of European Rubi who is not tainted with evolution has a faith in the fixity of species that very few things could shake.

DR. ROBERT CASPARY, director of the Botanical Garden, Königsburg, died September 18, from the effects of a fall. He was born at Königsburg, in 1818, and was originally an assistant professor at Bonn. His original work was chiefly anatomical, and the best known was his *Monograph on Water-Lilies*, a model of fullness and accuracy. He first pointed out the distinction of the endodermis or bundle-sheath. He also made a thorough investigation of the flora of Prussia.

THE SYNTHETICAL production of glucose by Drs. Fischer and Tafel in the chemical laboratory of the University of Würtzburg, recently announced in the *Berichte*, and referred to in *Nature* and *Science*, adds another to the list of vegetable products which can be formed artificially. Glucose is one of the most important substances having to do with the nutrition and growth of plants, and the discovery may confidently be expected to lead to valuable additions to the present knowledge of chemical changes within the living plant.

THE OROBANCHACEÆ have lately had full treatment at the hands of two investigators. M. Maurice Hovelacque presented to the French Academy of Sciences, recently, two notes,[1] entitled "Développement et valeur morphologique du suçoir des Orobanches," and "Sur le développement et la structure des jeunes Orobanches," while Dr. Ludwig Koch has just published[2] a book of nearly 400 pages on the "Entwickelungsgeschichte der Orobanchen, mit besonderer Berücksichtigung ihrer Beziehungen den Culturpflanzen."

[1]Comptes Rendus, cv, 470–473 and 530–533. (Sept., 1887.)
[2]Heidelberg, 1887. Winter's Universitäts buchhandlung.

PROF. JOHN MACOUN is now engaged on Part IV of his "Catalogue of Canadian Plants," which will be published next spring. It will contain the ferns and their allies, including the charas. Part V, to follow, will contain the lower cryptogams. Centuries of these are to be issued, determined by the most eminent authorities. The first century is about ready for distribution.

J. KRUTTSCHNITT, of New Orleans, has been making some observations on "Sarraceniaceæ or Pitcher Plants." Among them we quote the following: "The fly has evidently a task to perform in connection with the Sarraceniaceæ; it consists in exciting the plant to certain actions by the gentle friction exerted by the padded foot of the fly." Objecting to the theory of development, it is said, "the Sarraceniaceæ, after it has obtained its full growth, is brought into intimate connection with the fly; but the fly derives apparently no advantage from the Sarraceniaceæ." It is to be hoped that these valuable observations will be continued.

G. KARSTEN has discovered that under certain circumstances Fegatella (Conocephalus) conica reproduces by gemmæ. These gemmæ are only formed when the conditions are unfavorable for growth and the thallus is about to die. The whole vegetative strength is then concentrated upon the development of one or two globular gemmæ on the midrib beneath, which arise from the division of cells of the epidermis or the subjacent layer. Upon the return of suitable conditions for growth these gemmæ send out rhizoids and extend their single growing point into a narrow thallus, which, after attaining a certain length, suddenly broadens to the normal width. (See *Bot. Zeitung*, xlv, 649, Oct. 7, 1887.)

SEVERAL METHODS for preparing orchids for the herbarium so as to preserve their colors have been tried by R. Hegler, and the results given in the *Deutsche botanische Monatsschrift*. Salicylic acid was used with good success by dusting the dry substance upon the plants as they lie in the press. When they are taken out of the press the salicylic acid is removed from the flowers with a brush, and can be used for other plants. It specially preserves the intensity of the red colors. Powdered boracic acid may be used in the same way with nearly as good results. A solution of one part salicylic acid to fourteen parts of alcohol, applied by moistening pieces of blotting paper and placing them above and below the flowers in the press, or by wetting absorbent cotton and putting it in and about the flowers, forms a simple method of attaining the same end.

Mr. F. W. OLIVER has investigated the mode of conduction of the irritation in the stigmas of Martynia lutea and proboscidea and Mimulus luteus and cardinalis, and believes it to be due to the continuity of protoplasm from cell to cell, which he was able to demonstrate by Gardiner's method of sulphuric acid and Hoffmann's blue. In both the genera mentioned the tissue of the stigma consists of two lamellæ, which are sensitive to contact on the inner side only. The internal tissue of the lamellæ is composed of 15 to 20 layers of excessively thin-walled prismatic cells, with a great development of intercellular spaces. Between the lower and upper epidermis of the lamellæ runs a simple axile vascular bundle of spirally thickened tracheids. The bundles from the two stigmas do not unite before they reach the ovary. The irritability is confined to several layers of the prismatic cells of the inner side of the lamellæ, and it is here that the continuity of protoplasm from cell to cell was determined. . . . That the conduction does not take place through the vascular bundle was demonstrated by the fact that it was not affected by cutting the bundle.—*Jour. Roy. Mic. Soc.*

AN EXCERPT from *Comptes Rendus*, cv, p. 473 (although such source is not stated), giving an account of the new rot of the grape, Greeneria fuliginea, found in North Carolina by Messrs. Scribner and Viala, has been distributed. It states no facts in addition to those in the paper read by the authors before the Society for the Promotion of Agricultural Science.

T. F. BOURDILLON, writing to *Nature* from India, describes the fertilization of the coffee plant. It is protogynous and chiefly fertilized by bees, though somewhat visited by night-flying insects and butterflies. "Owing to all the plants of one clearing being usually grown from seed of a single estate, there must be a great deal of interbreeding, more especially as all the coffee of Ceylon and most of S. India is supposed to be descended from a single plant introduced into Batavia about two centuries ago." He suggests that this may have something to do with the deterioration of the younger coffee.

THE PROCEEDINGS of the Society for the Promotion of Agricultural Science have been printed and distributed with remarkable promptness, the credit for which is due the efficient secretary, Prof. W. R. Lazenby. Besides the nine papers mentioned in the September GAZETTE, the volume also contains the following articles of botanical interest: "A study of Poa pratensis," by W. J. Beal, in which the author seeks to determine whether the variations in growth are due to external or internal influences, but has neglected to state his conclusions. "A disease of broom-corn and sorghum," by T. J. Burrill, is a description of a disease of considerable economic importance, which the author traces by pure cultures and inoculations to a specific bacillus, whose appearance and transformations are described. It is a very important contribution to the subject of true bacterial parasites in plants. "Some botanical and horticultural generalizations," by E. Lewis Sturtevant, relate to the origin and stability of cultivated varieties. "Some crosses in corn," by A. A. Crozier, gives the result of observation and experiment, showing that "foreign pollen affects the appearance of the crossed kernels the first season, but also that an unusual appearance may be due to a cross of a previous year."

SINCE this number of the GAZETTE has gone to the printers, Dr. Asa Gray has been taken seriously ill. Late word from Cambridge indicates no change, but we hope for the best.

# GENERAL INDEX.

*** *Names of new species are printed in* **bold-face** *type; synonyms in italics; † signifies death.*


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